

5th to 27th. A decided change to colder came with the rain-storm of the 27th, and the last three days of the month were unusually cold, with frost generally in Kentucky and parts of Tennessee. Special warnings were issued for the frost.—*F. J. Walz, District Forecaster.*

CHICAGO FORECAST DISTRICT.*

[Indiana, Illinois, Michigan, Wisconsin, Minnesota, Iowa, Missouri, North Dakota, South Dakota, Nebraska, Kansas, and Montana.]

Except during the last few days of the month September was unusually warm. The change to cooler weather set in over the Western States on the 25th and advanced slowly eastward, bringing unseasonably cold weather and general frosts for which warnings were issued well in advance. Frost warnings were again issued on the 30th in advance of another cool area. Special frost warnings were issued to the cranberry marshes of Wisconsin on the 1st, 2d, and 6th, and in each case frost and freezing temperatures were reported in the bogs. The drought conditions continued from the previous summer months, and they were not effectually broken until the passage of the storm of the last week. The only disturbance that justified storm warnings crossed the upper Lakes on the 30th, and warnings were issued for this storm on the morning of that day.

The following action was taken by the South Dakota State Board of Agriculture in connection with a special forecast telegraphed from Chicago to the Local Office of the Weather Bureau at Huron, S. Dak., on September 8:

By resolution of the State Board of Agriculture, it is my duty and pleasure to express to you, and through you to the U. S. Weather Bureau, our sincere thanks for the long forecast given us for the week of our Fair. It was of great value for us to know this as it saved much expense in preparing for rain as we felt we should. Besides this it was a great relief of mind to the management to know that we could expect such fine weather.

J. W. CAMPBELL, *President,*

H. J. Cox, Professor and District Forecaster.

DENVER FORECAST DISTRICT.*

[Wyoming, Colorado, Utah, New Mexico, and Arizona.]

Except during the closing week the month was warm and dry. From the 23d to 26th a heavy storm of snow and rain moved from Wyoming to southern New Mexico. The storm was followed by one of the most severe cold spells on record during September in eastern portions of Wyoming, Colorado, and New Mexico. Timely warnings of frost and freezing temperature were issued in connection with the cold spell.—*P. McDonough, Local Forecaster, temporarily in charge.*

SAN FRANCISCO FORECAST DISTRICT.†

[California and Nevada.]

The most striking feature of the month was the storm that prevailed over southern California on the 23d to 25th. Generally speaking the rainfall was the heaviest during September

since records have been kept. It varied in amount from half an inch to several inches. The raisin-making section had ample warnings of the rains and the benefit of the service has been acknowledged. No frost nor storm warnings were issued during the month.—*A. G. McAdie, Professor and District Forecaster.*

PORTLAND, OREG., FORECAST DISTRICT.†

[Oregon, Washington, and Idaho.]

The month was unusually dry in western and northern sections, and temperature was slightly above normal east of the Cascade Mountains. A moderate disturbance crossed the northern portion of the district the last day of the month. Light frosts occurred on the 23d and 24th and heavy frosts on the 25th and 26th. Warnings of the storm and frosts were issued in time to be of service to those interested in them.—*E. A. Beals, District Forecaster.*

RIVERS AND FLOODS.

The feature of the month was the general drought that prevailed over the middle and northern districts east of the Rocky Mountains. Little or no rain fell over this extensive area until the end of the month, and all streams, except the Mississippi and Missouri, were at very low stages. The two larger rivers were not lower than usual for the season of the year.

The drought conditions were most severe in the Ohio Valley and the Middle Atlantic States, and in many places rivers were lower than ever before. Navigation was practically suspended on the Ohio, and many manufacturing plants in the upper Ohio Valley were compelled to suspend operations on account of lack of water.

Delayed reports of the flood of August and early September in the rivers of eastern South Carolina show that the damage caused thereby amounted to over \$900,000, divided as follows: Property loss, excluding crops, \$200,000; losses of crops, \$700,000. The losses due to erosion of land and suspension of business were reported great, but detailed reports were not available.

The highest and lowest water, mean stage, and monthly range at 211 river stations are given in Table IV. Hydrographs for typical points on seven principal rivers are shown on Chart I. The stations selected for charting are Keokuk, St. Louis, Memphis, Vicksburg, and New Orleans, on the Mississippi; Cincinnati and Cairo, on the Ohio; Nashville, on the Cumberland; Johnsonville, on the Tennessee; Kansas City, on the Missouri; Little Rock, on the Arkansas; and Shreveport, on the Red.—*H. C. Frankenfeld, Professor of Meteorology.*

* Morning forecasts made at district center; night forecasts made at Washington, D. C.

† Morning and night forecasts made at district center.

SPECIAL ARTICLES, NOTES, AND EXTRACTS.

RÉSUMÉ OF EXPERIMENTS IN AERODYNAMICS

By Dr. A. F. ZAHM. Dated Washington, D. C., August 24, 1908.

INTRODUCTION.

Aerodynamics may be defined broadly as the science of motion of air, or an aeriform fluid. Commonly air alone is implied in the word. This is especially true when the name is used by engineers. With them it is the analog of hydraulics, which is the science of motion of water. Both sciences treat not only of the movement of their peculiar media, but also of its effects on objects, or machinery, connected with the fluids.

An important function of aerodynamics is to determine the velocity and stress of air at every point of this medium, when it flows past an obstacle, the physical conditions of the fluid being given or observed by means of suitable instruments. From the point-velocity the stream-lines may be mapped; from

the point-stress about an object the resultant pressure and friction may be found by integrating over its surface.

Equivalent results may be obtained if the object move against the fluid, since only the relative motion is of consequence. Devices are in use, also, for revealing these integrated effects directly, without first finding the point-velocity and point-stress. Some of these will be described presently.

Experimental aerodynamics may be studied in its elements, as distinguished from its applications, by considering it under these heads: (1) velocity and stream-lines; (2) normal stress and resultant pressure; (3) shearing stress and resultant friction; (4) combined pressure and friction. To trace the development of even this much of the science would require a large volume.

The following pages present a brief sketch of such of the writer's experiments as may be classed under the above heads,